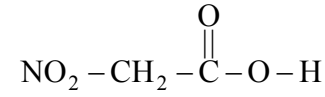
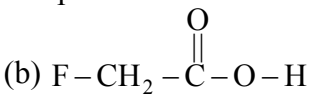
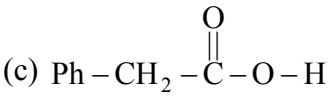
ACIDIC AND BASIC STRENGTHS

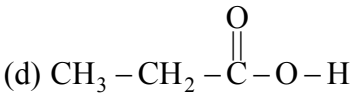
EXERCISE # O-I

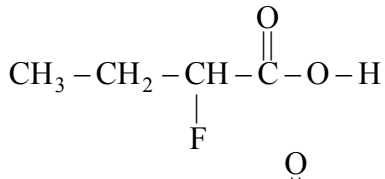
1. Write correct order of acidic strength of following compounds :

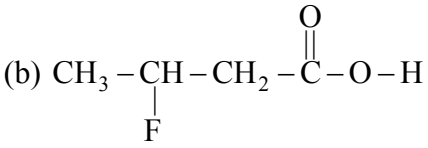
(i) (a) 

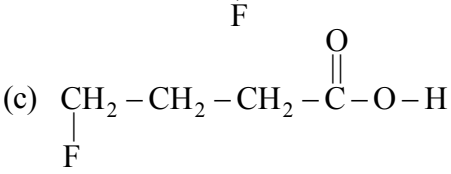
(b) 

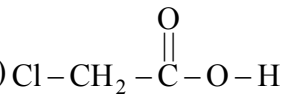
(c) 

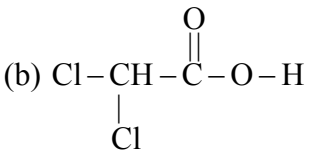
(d) 

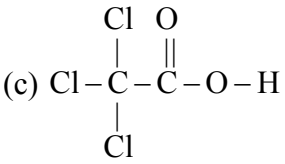
(ii) (a) 

(b) 

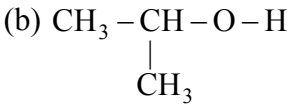
(c) 

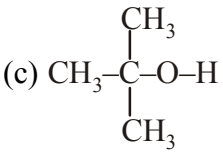
(iii) (a) 

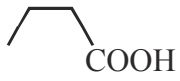
(b) 

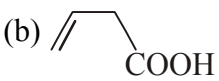
(c) 

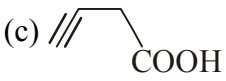
(iv)(a)

(b) 

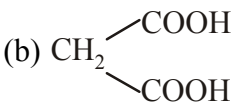
(c) 

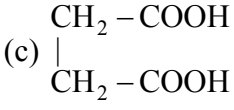
(v) (a) 

(b) 

(c) 

(vi) (a)

(b) 

(c) 

(vii) (a) H–F (b) H–Cl (c) H–Br (d) H–I

(viii) (a) CH_4 (b) NH_3 (c) H_2O (d) H–F

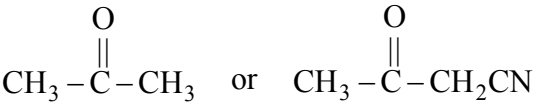
(ix)(a) $F–CH_2–CH_2–O–H$ (b) $NO_2–CH_2–CH_2–O–H$

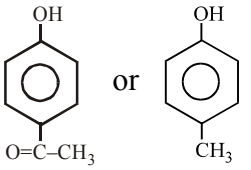
(c) $Br–CH_2–CH_2–O–H$ (d) $\overset{\oplus}{N}H_3–CH_2–CH_2–O–H$

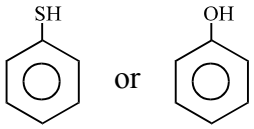
(x) (a) CH_3COOH (b) CH_3CH_2OH (c) C_6H_5OH (d) $C_6H_5SO_3H$

2. Explain which is a stronger acid.

(a) CH_3CH_3 or $BrCH_2NO_2$

(b)  or

(c)  or

(d)  or

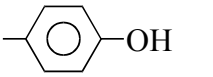
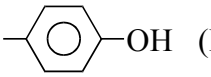
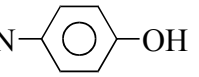
3. Which of the following would you predict to be the stronger acid ?

(a) Benzoic acid or para-nitrobenzoic acid

(b) $CH_3–CH_2–CH_2–OH$ or $CH_3–CH = CH – OH$

(c) $CH_3 – CH = CH – CH_2 – OH$ or $CH_3 – CH = CH – OH$

4. Arrange the given phenol & its derivative in their decreasing order of acidity :

(I) $C_6H_5–OH$ (II)  (III)  (IV) 

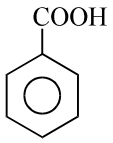
Select the correct answer from the given code:

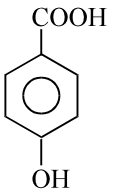
(A) IV > III > I > II (B) IV > II > III > I (C) IV > III > II > I (D) IV > I > III > II

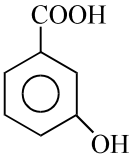
5. Which one of the following is the most acidic?

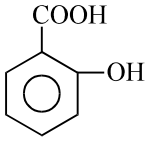
(A) (B) (C) (D) $CH_2=CH–CH_3$

6. Which of the following is weakest acid?

(A) 

(B) 

(C) 

(D) 

7. Arrange pH of the given compounds in decreasing order:

(1) Phenol (2) Ethyl alcohol (3) Formic acid (4) Benzoic acid

(A) 1 > 2 > 3 > 4 (B) 2 > 1 > 4 > 3 (C) 3 > 2 > 4 > 1 (D) 4 > 3 > 1 > 2

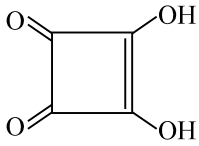
8. Arrange acidity of given compounds in decreasing order:

(I) $CH_3–NH–CH_2–CH_2–OH$ (II) $CH_3–NH–CH_2–CH_2–CH_2–OH$

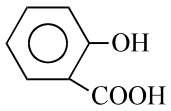
(III) $(CH_3)_3\overset{\oplus}{N}-CH_2-CH_2-OH$

(A) III > I > II (B) III > II > I (C) I > II > III (D) II > I > III

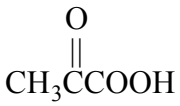
9. Consider the following compound



I



II

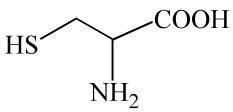


III

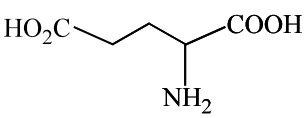
Which of the above compounds reacts with $NaHCO_3$ giving CO_2

(A) I, II and III (B) I and III (C) II and III (D) I and II

0. Say which pk_a belong to which functional group in case of following amino acids :

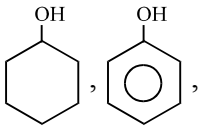
(i) cysteine : 

1.8, 8.3 & 10.8

(ii) glutamic acid : 

: 2.19, 4.25, 9.67

11. Record the following sets of compounds according to increasing pK_a (= – log Ka)

(a)  , cyclohexane carboxylic acid.

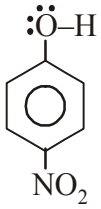
(b) 1-butyne, 1-butene, butane

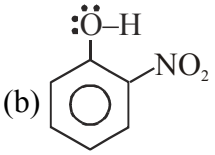
(c) Propanoic acid, 3-bromopropanoic acid, 2-nitropropanoic acid

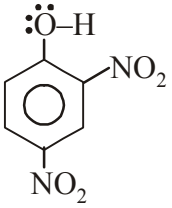
(d) Phenol,o-nitrophenol, o-cresol

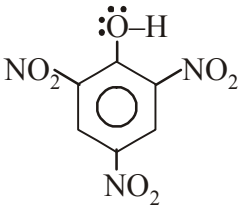
(e) Hexylamine, aniline, methylamine

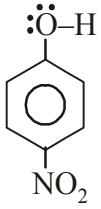
12. Write correct order of acidic strength of following compounds:

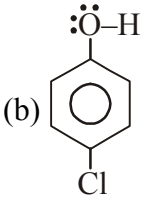
(i) (a) 

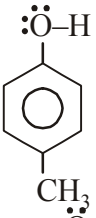
(b) 

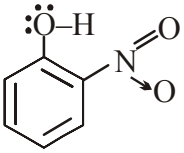
(c) 

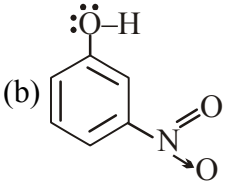
(d) 

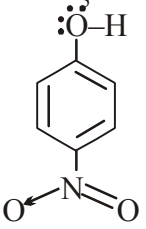
(ii) (a) 

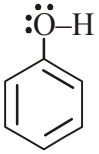
(b) 

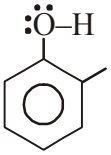
(c) 

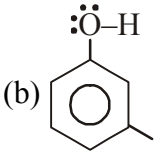
(iii) (a) 

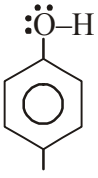
(b) 

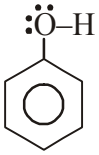
(c) 

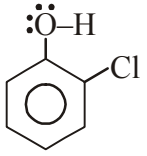
(d) 

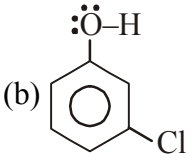
(iv) (a) 

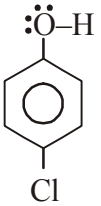
(b) 

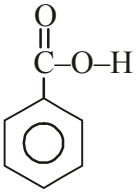
(c) 

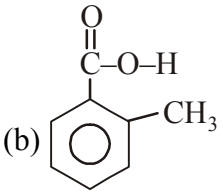
(d) 

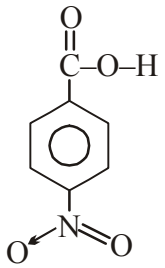
(v) (a) 

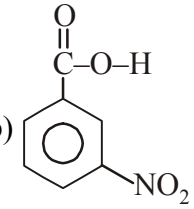
(b) 

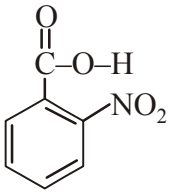
(c) 

(vi) (a) 

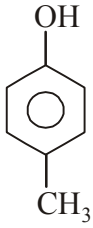
(b) 

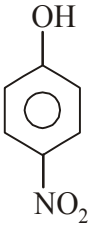
(vii) (a) 

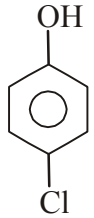
(b) 

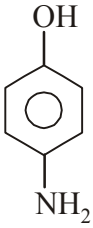
(c) 

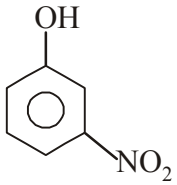
13. Select the strongest acid in each of the following sets :

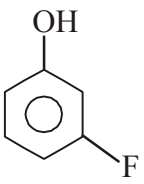
(i) (a) 

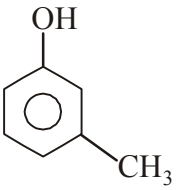
(b) 

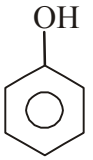
(c) 

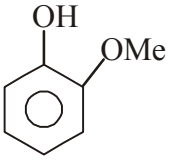
(d) 

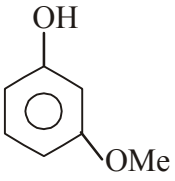
(ii) (a) 

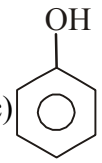
(b) 

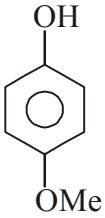
(c) 

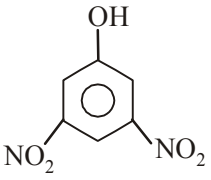
(d) 

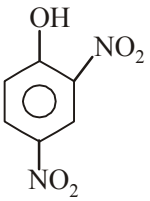
(iii) (a) 

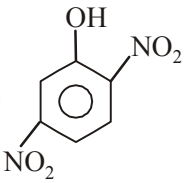
(b) 

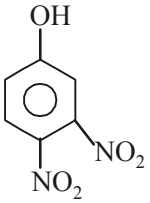
(c) 

(d) 

(iv) (a) 

(b) 

(c) 

(d) 

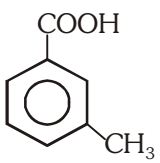
14. The strongest acid is :

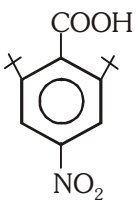
(A) HF (B) CH_3CO_2H (C) $HF + SbF_5$ (D) H_2S

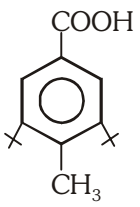
15. The weakest acid (does not show acidic character) is :

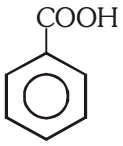
(A) $HC \equiv CH$ (B) $CH_2 = CH_2$ (C) Me_3CH (D) Ph

16. Which of the following is most acidic :

(A) 

(B) 

(C) 

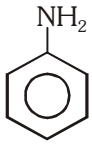
(D) 

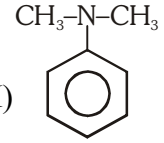
Paragraph for Question 17 to 18

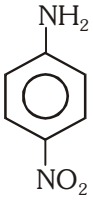
The most important condition for resonance to occur is that the involved atoms in resonating structure must be coplanar or nearly coplanar for maximum delocalisation. If this condition does not fulfil, involved orbitals cannot be parallel to each other and as a consequence delocalisation cannot occcur. Bulky groups present on adjacent atoms inhibit the planarity of atoms involved in resonance. This phenomenon is known as steric inhibition of resonance. Steric inhibition of resonance has profound effect on

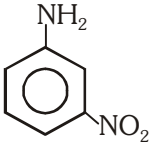
(1) Physical properties (2) Acidity and basicity (3) Reactivity of organic compounds

17. Arrange the following in the decreasing order of basicity :

(I) 

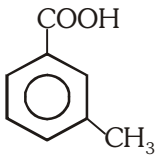
(II) 

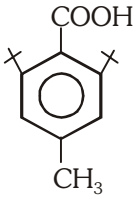
(III) 

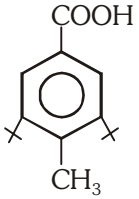
(IV) 

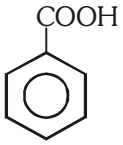
(A) I > II > III > IV (B) IV > III > II > I (C) II > I > IV > III (D) I > IV > III > II

18. Which of the following is most acidic :

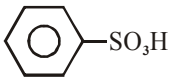
(A) 

(B) 

(C) 

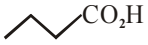
(D) 

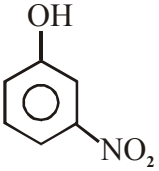
19. How many following compounds are more acidic than water ?

(a) 

(b) HCl

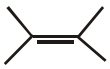
(c) $CH_3 - C \equiv CH$

(d) 

(e) 

(f)

(g)

(h) 

(i) NaOH

20. Select correct order regarding acidic strength of given compounds :

(1) o-methylbenzoic acid (2) m-methylbenzoic acid

(3) p-methylbenzoic acid (4) benzoic acid

(A)1 > 2 > 3 > 4 (B) 4 > 3 > 2 > 1 (C) 1 > 4 > 2 > 3 (D) 3 > 2 > 4 > 1

EXERCISE # O-II

1. Write decreasing order of basic strength of following :

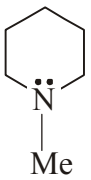
(i) (a) CH_3^- (b) NH_2^- (c) OH^- (d) F^-

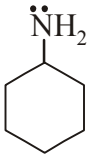
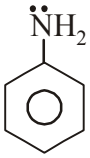
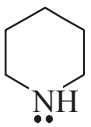
(ii) (a) F^- (b) Cl^- (c) Br^- (d) I^-

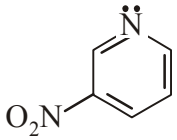
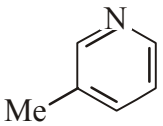
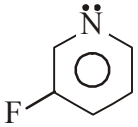
(iii) (a) NH_3 (b) $MeNH_2$ (c) Me_2NH (d) Me_3N (in H_2O)

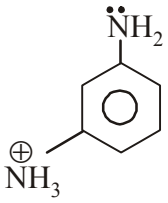
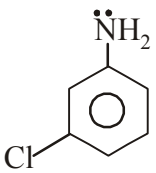
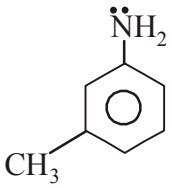
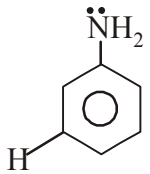
(iv) (a) NH_3 (b) $MeNH_2$ (c) Me_2NH (d) Me_3N (Gas phase)

(v) (a) $R–NH_2$ (b) $Ph–NH_2$ (c)

(vi) (a) (b) (c) 

(vii)(a)  (b)  (c) 

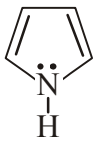
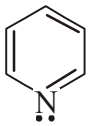
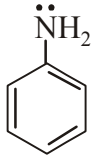
(viii) (a)  (b)  (c) 

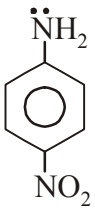
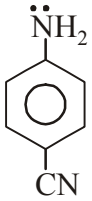
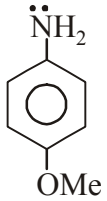
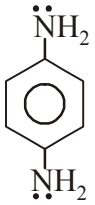
(ix) (a)  (b)  (c)  (d) 

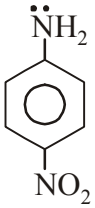
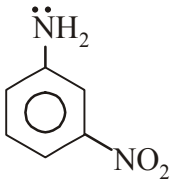
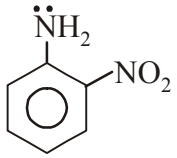
2. Write decreasing order of basic strength of following :

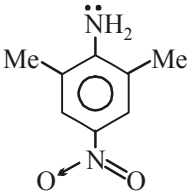
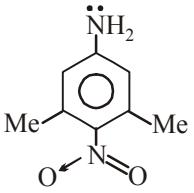
(i) (a) $CH_3–CH_2–\ddot{N}H_2$ (b) $CH_3–CH=\ddot{N}H$ (c) $CH_3–C\equiv\ddot{N}$

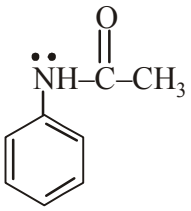
(ii) (a) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-\ddot{N}H_2$ (b) $CH_3–CH_2–\ddot{N}H_2$ (c) $CH_3-\overset{\overset{\displaystyle \ddot{N}H}{\|}}{C}-\ddot{N}H_2$ (d) $\ddot{N}H_2-\overset{\overset{\displaystyle \ddot{N}H}{\|}}{C}-\ddot{N}H_2$

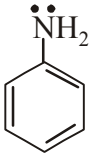
(iii) (a)  (b)  (c) 

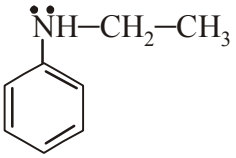
(iv) (a)  (b)  (c)  (d) 

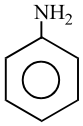
(v) (a)  (b)  (c) 

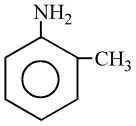
(vi) (a)  (b) 

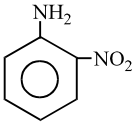
(vii) (a) 

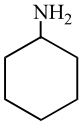
(b) 

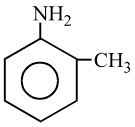
(c) 

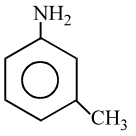
(viii) (a) 

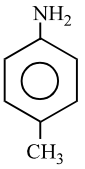
(b) 

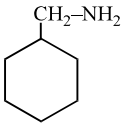
(c) 

(d) 

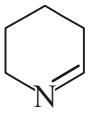
(ix) (a) 

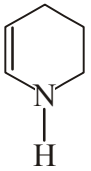
(b) 

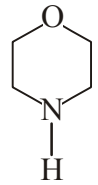
(c) 

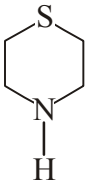
(d) 

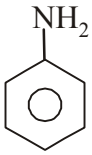
3. Select the strongest base in following compound :

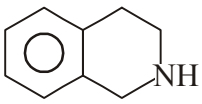
(i) (a) 

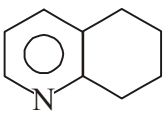
(b) 

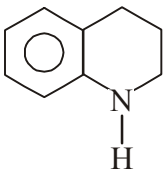
(c) 

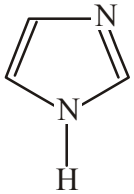
(d) 

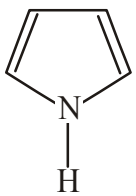
(ii) (a) 

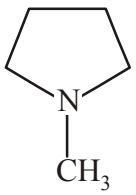
(b) 

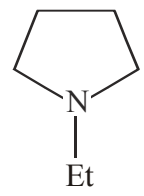
(c) 

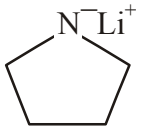
(d) 

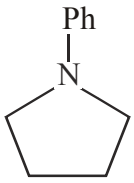
(iii) (a) 

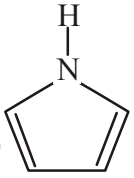
(b) 

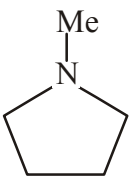
(c) 

(d) 

(iv) (a) 

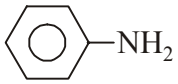
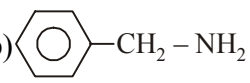
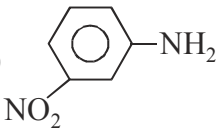
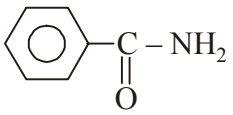
(b) 

(c) 

(d) 

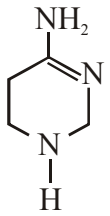
4. Arrange the following compound in decreasing order of their basicity.

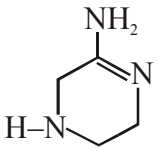
(i) (a) $H_2C = CHNa$ (b) CH_3CH_2Na (c) CH_3CH_2ONa (d) $HC \equiv CNa$

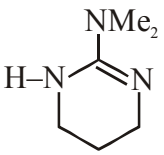
(ii) (a)  (b)  (c)  (d) 

(iii) (a) HO^- (b) NH_3 (c) H_2O (d) HSO_4^-

5. Correct decreasing order of basic strength -


(I)


(II)


(III)

Of following compound -

(A) III > II > I (B) II > I > III (C) I > II > III (D) III > I > II

6. Consider the following bases:

(I) o-nitroaniline (II) m-nitroaniline (III) p-nitroaniline

The decreasing order of basicity is:

(A) II > III > I (B) II > I > III (C) I > II >III (D) I > III > II

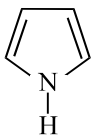
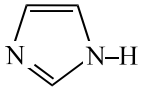
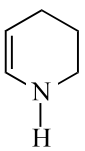
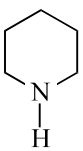
7. Consider the basicity of the following aromatic amines:

(I) aniline (II) p-nitroaniline (III) p-methoxyaniline (IV) p-methylaniline

The correct order of decreasing basicity is:

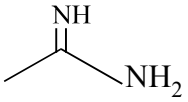
(A) III > IV > I > II (B) III > IV > II > I (C) I > II > III > IV (D) IV > III > II > I

8. Which one of the following is least basic in character?

(A)  (B)  (C)  (D) 

9. In each of the following pair of compounds, which is more basic in aqueous solution? Give an explanation for your choice:

(a) CH_3NH_2 or CF_3NH_2

(b) CH_3CONH_2 or H_2N  NH_2

(c) $CH_3CH_2CH_2NH_2$ or CH_3CN

(d) $C_6H_5N(CH_3)_2$ or 2,6-dimethyl-N-N-dimethylaniline

10. Choose the member of each of the following pairs of compunds that is likely to be the weaker base.

(a) H_2O or H_3O^+

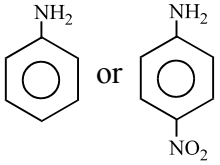
(b) Cl^-, SH^-

(c) F^-, OH^-, NH_2^-, CH_3^-

(d) HF, H_2O, NH_3

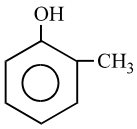
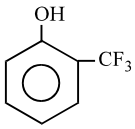
(e) OH^-, SH^-, SeH^-

11. Explain which compound is the weaker base.

(a)  or

(b) $CH_2 = CH - CH = CH - CH_2^-$ or $CH_2 = CH - CH_2^-$

(c) $\begin{matrix} COO^- \\ | \\ COOH \end{matrix}$ or $\begin{matrix} COOH \\ | \\ COOH \end{matrix}$

(d)  or 

12. Arrange the basic strength of the following compounds.

(a) OH^- CH_3COO^- Cl^-

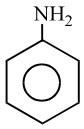
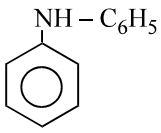
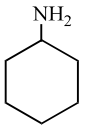
(i) (ii) (iii)

(b) $CH \equiv C^-$ $CH_2 = CH^-$ $CH_3CH_2^-$

(i) (ii) (iii)

(c) $CH_2 = CHCH_2NH_2$ $CH_3CH_2CH_2NH_2$ $CH \equiv C - CH_2NH_2$

(i) (ii) (iii)

(d)   

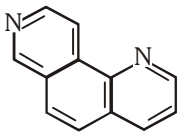
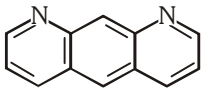
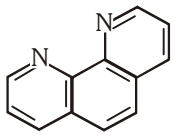
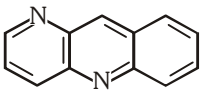
(i) (ii) (iii)

13. Arrange the following compounds in order of increasing basicity.

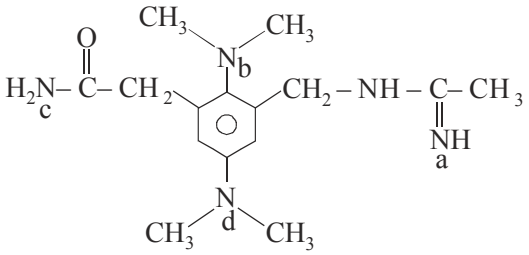
(a) CH_3NH_2, $CH_3NH_3^{\oplus}$, CH_3NH^{-}

(b) CH_3O^{-}, CH_3NH^{-}, $CH_3CH_2^{-}$

14. Which of the following is most basic :

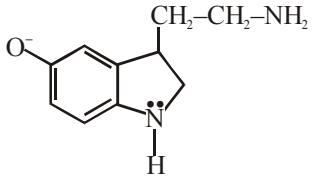
(A)  (B)  (C)  (D) 

15. Basicity order of N in following compound is :



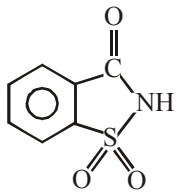
(A) b > d > a > c (B) a > b > d > c (C) a > b > c > d (D) a > c > b > d

16. The conjugate base of serotonin (used as tranquilisers) is given as follows :

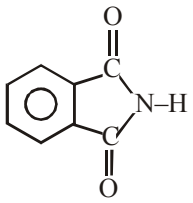


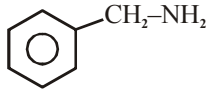
How many basic groups present in following compound ?

17. The structure of saccharin is given as follows :

 [Provided N is the donor atom in all cases]

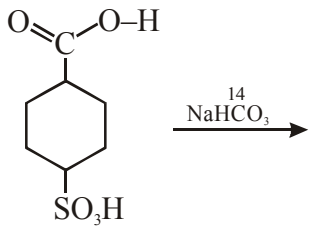
How many following compounds are more basic than saccharin ?

(i) $CH_3-\underset{\underset{NH}{\|}}{C}-NH_2$ (ii) $H_2N-\underset{\underset{NH}{\|}}{C}-NH_2$ (iii) $CH_3-\underset{\underset{O}{\|}}{C}-NH_2$ (iv) 

(v)  (vi)

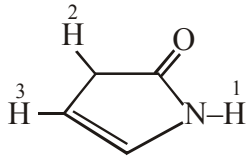
EXERCISE # S-I

1. In given reaction Gas liberated is/are



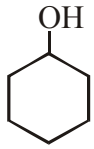
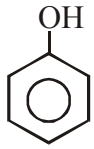
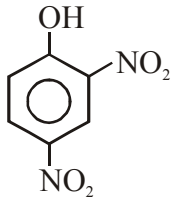
(A) CO_2 & SO_3 (B) SO_3 & $^{14}CO_2$ (C) $^{14}CO_2$ only (D) SO_2 only

2. Arrange marked atom in decreasing order of acidic strength

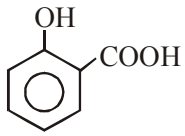


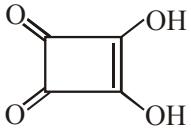
(A) 1 > 2 > 3 (B) 3 > 2 > 1 (C) 2 > 1 > 3 (D) 2 > 3 > 1

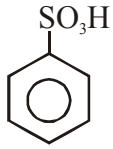
3.

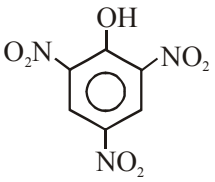
Column - I	**Column-I**
(A) 	(P) React with NaOH
(B) 	(Q) React with $NaHCO_3$
(C)	(R) React with NaH
(D) 	(S) React with Na
	(T) React with $NaNH_2$

4. Compound which can give effevescences with $NaHCO_3$

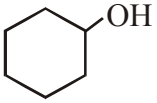
(i)  (Salicylic acid)

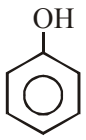
(ii)  (Squaric acid)

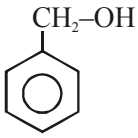
(iii)  (Benzene sulphonic acid)

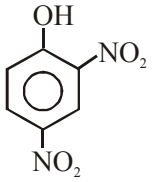
(iv)  (Picric acid)

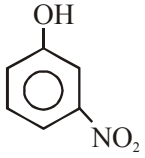
(v) Ph–CH=CH–COOH (cinnamic acid)

(vi) 

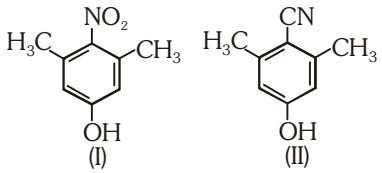
(vii) 

(viii) 

(ix) 

(x) 

5. **Statement-1 :** For the given two compounds-I is more acidic than compounds-II.



(I) (II)

and

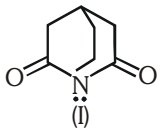
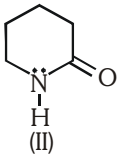
Statement-2 : Due to presence of $-CH_3$ group at ortho positions to $-NO_2$; the plane of $-NO_2$ deviates, w.r.t plane of ring.

(A) Statement-1 is True, Statement-2 is True ; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1 is True, Statement-2 is True ; Statement-2 is NOT a correct explanation for Statement-1.

(C) Statement-1 is True, Statement-2 is False.

(D) Statement-1 is False, Statement-2 is True.

6. **Statement 1** :  is more basic than 

and

Statement 2 : Lone pair electrons on nitrogen in compound (I) does not participate in resonance.

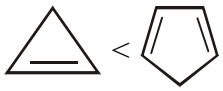
(A) Statement-1 is True, Statement-2 is True ; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1 is True, Statement-2 is True ; Statement-2 is NOT a correct explanation for Statement-1.

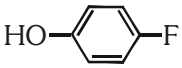
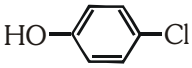
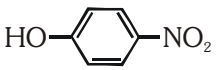
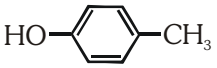
(C) Statement-1 is True, Statement-2 is False.

(D) Statement-1 is False, Statement-2 is True.

7. Match Column-I with Column-II.

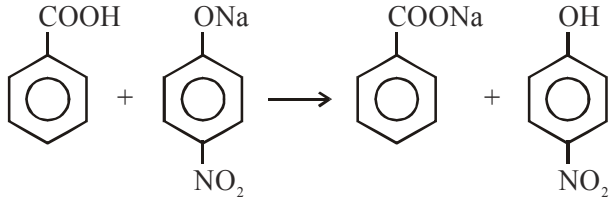
Column - I (Facts)	**Column - II (Reasons)**
(A) Guanidine $H_2N-\underset{\underset{NH}{\|}}{C}-NH_2$ is example of strong base	(P) Resonance stabilisation of conjugate acid of strong base.
(B) Carbanion stability $\bar{C}Cl_3 > \bar{C}F_3$	(Q) Due to s-character of central atoms
(C) Alkyne is more acidic than alkene	(R) Due to d-orbital resonance
(D) Acidity : 	(S) Due to formation of aromatic anion
	(T) Stability of conjugate acid / base due to more number of identical resonating structure

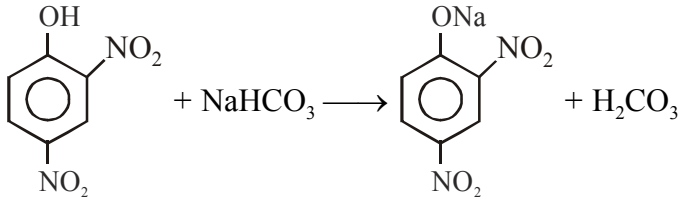
8. Match Column-I with Column-II.

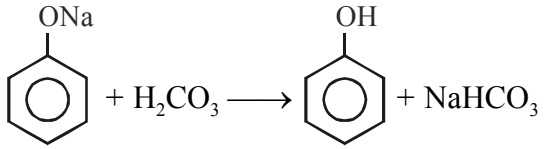
Column - I (Compounds)	**Column - II (pKa)**
(A) 	(P) 7.15
(B) 	(Q) 10.14
(C) 	(R) 9.98
(D) 	(S) 9.38
	(T) pKa is more than phenol

(Comprehension) (Q.9 to Q.11)

Observe the following feasible reactions :

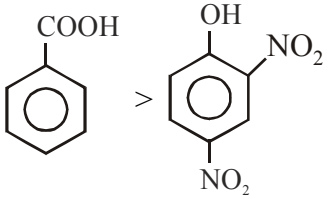
(i) 

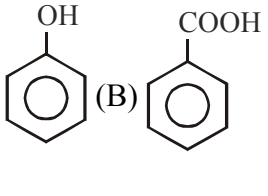
(ii) 

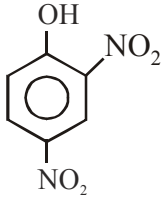
(iii) 

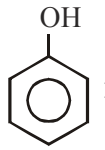
Answer the following question :

9. Which of the following is the correct order of acidic strength.

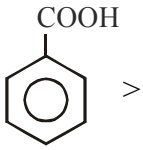
(A) 

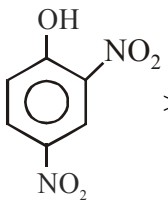
$> H_2CO_3 >$ (B) 

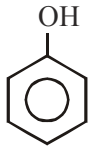




$> H_2CO_3$

(C) 

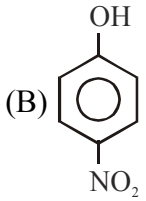
$> H_2CO_3 >$ 

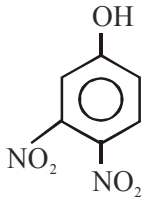


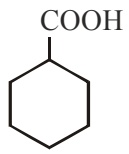
(D) None

10. Which of the following compound does not react with $NaHCO_3$

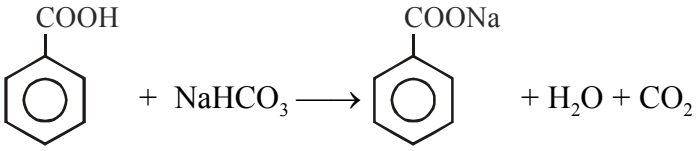
(A)

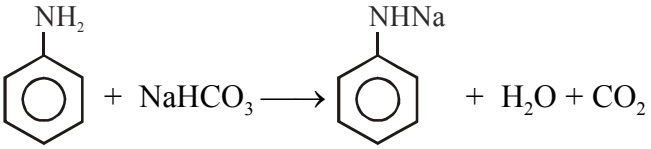
(B) 

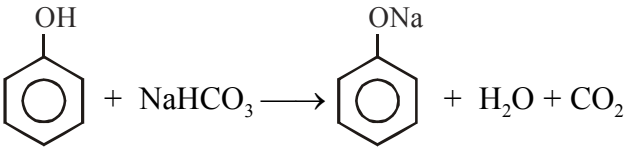
(C) 

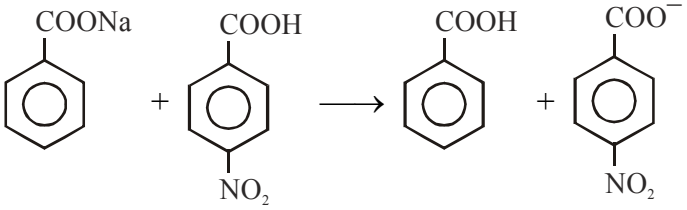
(D) 

11. Identify the feasible reactions

(A) 

(B) 

(C) 

(D) 

12. Identify the non-feasible reaction

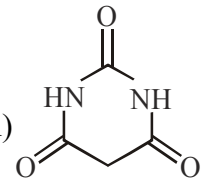
(A) $CH_3–C \equiv CH + NH_2^- \rightleftharpoons CH_3—C \equiv \ddot{\underline{C}}^{\cdot\cdot} + NH_3$

(B) $CH_3CH_2—OH + NaH \rightleftharpoons CH_3CH_2ONa + H_2$

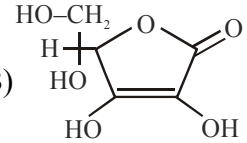
(C) $CH_3—OH + NaOH \rightleftharpoons CH_3ONa + H_2O$

(D) $HC\equiv CH + NaOH \rightleftharpoons HC\equiv CNa + H_2O$

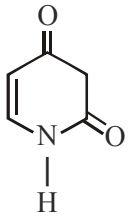
13. Select the number of compounds in which deprotonation gives aromatic anion :

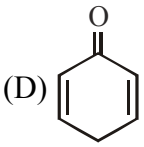
(A) 

Barbituric acid

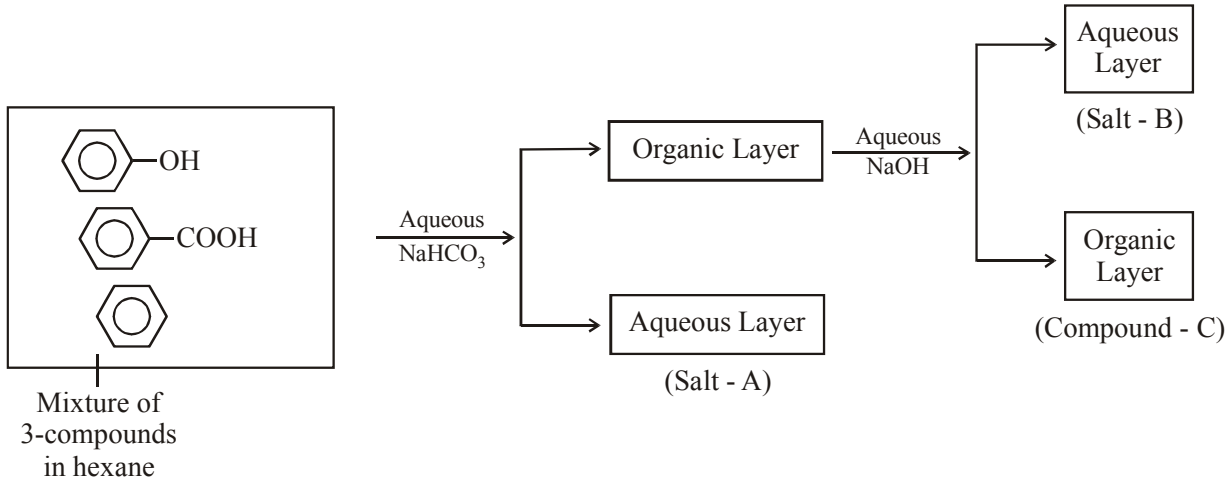
(B) 

Ascorbic acid
(Vitamin-C)

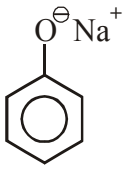
(C) 

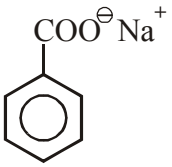
(D) 

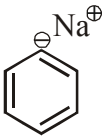
Paragraph for Questions 14 and 15



14. Identify salt 'A' ?

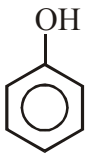
(A) 

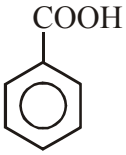
(B) 

(C) 

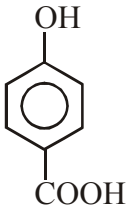
(D) All of these

15. Identify compound 'C' ?

(A) 

(B) 

(C)

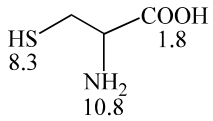
(D) 

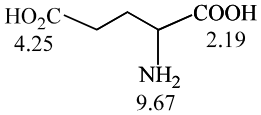
EXERCISE # O-I

1. **(i) a > b > c > d,** **(ii) a > b > c ,** **(iii) c > b > a,** **(iv) a > b > c,**
(v) c > b > a, **(vi) a > b > c** **(vii) d > c > b > a ,** **(viii)d > c > b > a,**
(ix) d > b > a > c, **(x) d > a > c> b**

2. **(a) 2 ; (b) 2 ; (c) 1 ; (d) 1** **3.** **(a) 2 ; (b) 2 ; (c) 2** **4.** **(C)** **5.** **(B)**

6. **(B)** **7.** **(B)** **8.** **(A)** **9.** **(A)**

10. **(i) cysteine :** 

(ii) glutamic acid : 

11. **(a) 3 < 2 < 1 ; (b) 1 < 2 < 3 ; (c) 3 < 2 < 1 ; (d) 2 < 1 < 3 ; (e) 2 < 3 < 1**

12. **(i) d > c > a > b,** **(ii) a > b > c,** **(iii) c > a > b > d,** **(iv) d > b > c > a,**
(v) a > b > c, **(vi) b > a** **(vii) c > a > b**

13. **(i) b , (ii) a, (iii) b , (iv) b** **14.** **(C)** **15.** **(C)** **16.** **(B)**
17. **(C)** **18.** **(B)** **19.** **(4)** **20** **(C)**

EXERCISE # O-II

1. **(i) a > b> c> d,** **(ii) a > b > c > d,** **(iii) c > b> d> a ,** **(iv) d > c > b > a**
(v) a > b > c, **(vi) c > b > a** **(vii) c > a > b,** **(viii) b > c > a,** **(ix) c > d > b > a**

2. **(i) a > b > c,** **(ii) d > c > b > a,** **(iii) b > c > a,** **(iv) d > c > b > a,**
(v) b > a > c, **(vi) b > a,** **(vii) c > b > a,** **(viii) d > a > b > c**
(ix) d > c > b > a

3. **(i) d, (ii) b, (iii) a, (iv) a**

4. **(i) b > a > d > c,** **(ii) b > a > c > d,** **(iii) a > b > c > d**

5. **(A)** **6. (A)** **7. (A)** **8. (A)**

9. **(a) i , (b) ii , (c) i , (d) ii** **10. (a) 2 ; (b) 1 ; (c) 1 ; (d) 1 ; (e) 3**

11. **(a) 2; (b) 1;(c) 2; (d) 2** **12. (a) 1 > 2 > 3 ; (b) 1 < 2 < 3 ; (c) 3 < 1 < 2 ; (d) 2 < 1 < 3**

13. **(a) 2 < 1 < 3 ; (b) 1 < 2 < 3** **14. (C)** **15. (B)**

16. **3, 3 basic groups are** $\ddot{N}H_2$; –NH–; O^- **17.** **(6)**

EXERCISE # S-I

1. **(C)** **2.** **(C)**

3. **(A) – R, S, T ; (B) – P, R, S, T ; (C) – P, Q, R, S, T ; (D) – P, Q, R, S, T**

4. **(i) , (ii) (iii) (iv), (v) (ix)** **5.** **(D)** **6.** **(A)**

7. **(A) – P,T ; (B) – R; (C) – Q ; (D) – S, T** **8.** **(A) – R ; (B) – S; (C) – P ; (D) – Q, T**

9. **(A)** **10.** **(A)** **11.** **(A, D)** **12.** **(D)**

13. **(A, B, C, D)** **14.** **(B)** **15.** **(C)**